NESTUCCA OIL SPILL: IMPACT ASSESSMENT ON AVIAN POPULATIONS AND HABITAT

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Abstract

To help assess the impact of the Nestucca oil spill in British Columbia, we 1) inspected seabird breeding colonies and known waterbird wintering and migrating areas for the presence of oil, 2) carried out aerial surveys to locate wintering concentrations of waterbirds, and 3) quantified avian mortality related to oil.

A total of 3568 dead oiled birds were found on the west coast of Vancouver Island between 3 January and 19 April 1989. Thirty-one species were identified in a sample of 856 dead birds analysed. Common Murres (42%) and Cassin's Auklets (32%) were most affected.

Oil was encountered on seabird breeding colony islands from Seabird Rocks, south of Barkley Sound on the west coast of Vancouver Island, to as far north as the Moore Islands, north of Bella Bella on the northern mainland coast. Colony islands most impacted by oil were Seabird Rocks, Cleland Island, Thornton Island, and the "Gull" islet in the Bunsby Islands. Areas of waterbird concentrations around Stubbs Island, Bunsby Islands, Sea Otter Cove and Chesterman's Beach (an internationally important area for shorebird migration) were also impacted.

Résumé

Afin de déterminer l'impact du déversement de pétrole Nestucca en Colombie Britanique, nous avons 1) visité les colonies d'oiseaux marins de même que les endroits d'hivernage et de migrations utilisés dans le passé par les oiseaux aquatiques, 2) effectué des inventaires aériens afin de localiser les concentrations d'oiseaux aquatiques présentes dans la région, et 3) déterminé de facon quantitative la mortalité avienne reliée au deversement. Au total, 3568 oiseaux morts ont été dénombrés sur la côte ouest de Vancouver entre le 3 janvier et le 19 avril 1989. Trente et une espèces d'oiseaux furent identifiés parmi un échantillonnage de 856 oiseaux morts. La Marmette commune et l'Alque de Cassin furent les espèces les plus affectées représentant respectivement 42 et 32% des fatalités. On a observé de l'huile sur plusieurs colonies d'oiseaux marins, de "Seabird Rocks", au sud du détroit de Barkley sur la côte ouest de l'île de Vancouver jusqu'aux îles "Moore", au nord de Bella Bella. Les colonies les plus affectées incluent: "Seabird Rocks", l'îles Cleland, Thornton et l'îslet des goélands dans le groupe des îles Bunsby. Plusieurs endroits importants pour les oiseaux aquatiques furent aussi affectés: le secteur des îles Stubbs et Bunsby, la baie de la Loutre de mer (Sea Otter Cove) et la baie de Chesterman (un endroit d'importance internationale pour la migration des bécasseaux).

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We were greatly assisted in our efforts to quantify and identify dead, oiled birds by the staff at the Pacific Rim National Park Warden's office who kept daily tallies of birds found on park beaches. They collected the majority of those birds, and, with the help of Mark Hobson, set up a work area for us at the Warden's office where we could identify them. Thanks to all the staff for their cooperation, especially Mac Elder, Dan Vedova and Earl Wilson.

We would also like to extend our appreciation to all the volunteers and paid workers who collected and kept records of the numbers of dead birds encountered during surveillance and clean-up efforts. Special thanks to Dave Leblanc and to members of the Nuu-chah-nalth Tribal Council and the Kwakiutl District Council.

Alan Burger helped identify samples of dead birds, and Don Garnier and other volunteers assisted with the macabre task of sorting oiled birds.

The majority of our surveys were conducted with charter Vancouver Island Helicopter MPI, piloted by Paul Jahnke. His flying finesse combined with his personal interest in the surveys contributed to the quality of information obtained.

Introduction

According to U.S. authorities, the Nestucca barge was damaged and began leaking oil off Grays Harbour, Washington on 23 December 1988. The barge was subsequently towed offshore, still leaking oil, to the edge of the continental shelf. Oil travelled northward and was first recorded on the British Columbia coast on 31 December 1988. As part of the impact assessment of the Nestucca oil spill in British Columbia, we quantified and analysed oiled bird mortality, maintained surveillance for the presence of oil on seabird breeding colony sites and known wintering and migration areas, and surveyed coastal habitat in proximity to oiled areas for wintering waterbird concentrations. In the course of those surveys we kept records of sightings of oil in other areas (Appendix I). Surveys were conducted between 8 January and 3 February 1989.

Methods

To quantify avian mortality we asked all persons involved in surveillance or clean-up operations to keep records of numbers of dead birds encountered and deliver them to the Park Warden's office or directly to us at headquarters at Amphitrite Point for identification. A total of 856 birds were collected and identified. Ainley *et al.* (1980) was used to help in identification. To monitor changes in species composition of dead birds over time, we kept daily records of species collected on Pacific Rim National Park beaches (Long Beach Unit) after the week of 3-9 January. Beaches from Florencia Bay to Schooner Cove were regularly inspected by park wardens and volunteers.

Visits to seabird colonies and surveys for waterbird concentrations were conducted by helicopter. Seabird colonies were landed on and explored on foot where possible. Inaccessible shoreline areas were inspected for oil by low fly-overs below 5 m elevation. Aerial bird surveys were flown at about 60 m elevation with frequent circling and lower passes to identify species. There

were at least two observers on each flight, positioned in the left front and right rear seats of the helicopter. When a third observer was present they sat in the left rear seat. Sightings were reported to one notekeeper. Flight times and weather conditions are detailed in Appendix II. Flight lines are shown on maps in Appendix III. Scientific names of bird species are listed in Appendix IV.

RESULTS

Waterbird mortality

A total of 3,226 dead, oiled birds were found and reported washed up on the western shores of Vancouver Island between 3 January and 8 February 1989 (Table 1). Most dead birds were recorded from beaches within the Long Beach Unit of Pacific Rim National Park (44%) and from the Tofino and Clayoquot Sound area (Portland Pt. to Sharp Pt.) (32%). Those areas were frequently and thoroughly inspected, and counts are probably close to the actual numbers of birds that washed ashore in those areas. Counts from less accessible areas are likely less complete. In some areas birds were not separated from oil debris during the clean-up and counts were not available. Dead, oiled birds were found over the entire length of Vancouver Island, from Sooke to Cape Scott. Five oiled birds (2 Pacific Loons, 1 White-winged Scoter and 2 Common Murre), all of which died, were collected in the Nanaimo area between 29 December 1988 and 13 January 1989 (Ken Langelier pers. comm.). These were presumed to have flown into the area after being oiled. Oil from two of those birds was analyzed and identified as oil from the Nestucca barge. Dead birds were still being found on beaches after the main surveillance and cleanup effort ended. A previously undetected area of heavy oiling in the islands in Barkley Sound near the mouth of Ucluelet Inlet was discovered and cleaned

between 20 February and 12 March 1989. A total of 326 birds were found in this area (200 on George Fraser Island; 50 in Stuart Bay; 35 on Francis I.; 25 on Beg I.; and 16 on Benson I. [K. Hebron, EPS pers. comm.; Nuu-chah-nulth Tribal Council]). The birds were in an advanced state of decay and had likely come ashore much earlier. On a brief excursion on 23 March along a section of the West Coast Trail between Pachena Pt. and Valencia cliffs, 10 heavily oiled carcasses were found, nine of which were completely scavenged (M. Lemon, pers. obs.). On Brady's Beach, west of Bamfield, a Northern Fulmar with 10% of its body oiled, washed ashore on 1 April (M. Rodway pers. obs.). Including all these observations, a total of 3,568 dead, oiled birds were found on British Columbia shores as of 19 April 1989. It is unknown what proportion of the total mortality is represented by the carcasses that were found washed ashore.

Thirty-one species were identified in the sample of 856 dead birds (Table 2). Common Murres (42%) and Cassin's Auklets (32%) were most numerous, with scoters (6%), gulls (4%) and loons (3%) comprising smaller proportions. Unexpected numbers of Parakeet Auklets (15) were found in the mortality sample (see Campbell et al. in press). The number of inshore or near-shore species increased over time. Nineteen species were identified in the first sample of birds collected on park beaches from 3-9 January. An additional six species were identified in daily samples collected between 10 and 13 January, five of which were inshore or near-shore species (Table 3). The vast majority (94%) of the dead birds inspected were saturated with oil. Small numbers of Common Murres, Glaucous-winged Gulls, loons, scoters and other nearshore species were only partially oiled (Table 4). The proportion of partially oiled birds increased over time, comprising only 3% of the carcasses identified between 3 and 18 January (N = 646), 14% between 19 and 22 January (N = 147), and 29% between 23 January and 3 February (N = 48).

Many of the carcasses including those completely coated with oil, were partially scavenged. Of a sample of 146 carcasses collected between 18 January and 2 February, 54% had been scavenged, 39% heavily (Alan Burger pers. comm.). Bald Eagles, Common Ravens and Northwestern Crows were observed scavenging beached birds, and reports of eagles with oiled heads were received.

Only 33 live birds were brought to rehabilitation centres in Tofino (30) and Ucluelet (3), 19 of which were subsequently released (Ken Langelier pers. comm.; Friends of Clayoquot pers. comm.). Twenty-six of those birds were treated through the Nanaimo Veterinary Hospital (1 Common Loon, 3 Red-necked Grebes, 2 Horned Grebes, 2 White-winged Scoters, 1 Mew Gull, 6 Glaucous-winged Gulls, 7 Common Murres, 1 Pigeon Guillemot and 3 Ancient Murrelets). About 10% to 20% of the live gulls in the Pachena Bay - Ucluelet area were partially oiled (Alan Burger pers. comm. - 22 January), and oiled loons, grebes and scoters were frequently sighted in the Bunsby Islands area (Jane Watson pers. comm. - 22 January). We observed heavily oiled birds as far south as Keeha Bay, near Cape Beale (1 Red-necked Grebe) and as far north as Triangle Island (1 adult Glaucous-winged Gull). A chronic level of mortality of those partially oiled birds is expected.

Occurrence of oil on seabird breeding colony sites and important waterbird wintering and migration areas

Oil was encountered on seabird breeding colony islands from Seabird Rocks south of Barkley Sound on the west coast of Vancouver Island to as far north as the Moore Islands north of Bella Bella on the northern mainland coast (Fig. 1). Small patties of oil were found on Triangle Island. Only the colonies south of the Brooks Peninsula had quantities of oil that were potential threats to avian populations and required clean-up. Small amounts

of oil observed on Triangle Island and on the colony sites off the northern mainland coast were removed as we found them. Colony islands worst hit by oil were the gull nesting islet at the southwest corner of the Bunsby Islands, Thornton Island, Cleland Island and Seabird Rocks. Large amounts of oil came ashore on the west end of the Brooks Peninsula just south of Solander Island. Areas of waterbird concentrations around Stubbs I., Bunsby Is., Sea Otter Cove and the internationally important area for shorebird migration along Chesterman's beach were also impacted (Table 5). Clean-up has occurred at all those sites, but final evaluation has yet to be conducted.

Wintering waterbird concentrations in proximity to oiled areas

Coastal areas from Pachena Bay to Cape Scott on the west coast of Vancouver Island, and areas around the Moore Islands and Goose Island on the northern mainland coast that were possibly contaminated with oil were surveyed for wintering waterbird concentrations between 11 January and 2 February 1989 (Table 6). Cormorants and White-winged Scoters were the most abundant species seen along the outer coastline. Concentrations of cormorants were observed on "White" Island (2000), and on, and north of, Thornton Island (910 Brandt's Cormorants). Up to 1050 White-winged Scoters were counted in Checleset Bay in the vicinity of the Bunsby Islands, and 417 were sighted around the Scott Islands. In protected waters, concentrations of waterfowl occurred in the Goose Island lagoon (192+), Hansen Lagoon (363), Sea Otter Cove (503), Nuchatlitz Inlet (397), Hesquiat Harbour (905), and the Tofino mudflat-Grice Bay area (1840). Surf Scoter, Bufflehead, Mallard and Canada Geese were the most abundant waterfowl species observed in those areas. Groups of Mallards were also encountered at creek mouths along the outer coast (127 on the west coast of Nootka Island). Flocks of Western Grebes were

sighted in Macoah Passage (120), at the mouth of Sydney Inlet (90), in Clanninick Cove (70) and Klashkish Inlet (60). We observed a group of 800 Dunlin on Stubbs Island in Clayoquot Sound (1 February), and smaller flocks of shorebirds, primarily Surfbirds, were frequent on outer rocky shores. Groups of Brant were present north of Estevan Point (200 on 27 January - Lee Harding pers. comm.) and in Grice Bay (120 on 1 February). A maximum total of 159 swans, including 13 on interior ponds on Calvert and Price islands were sighted in the areas surveyed. No evidence of distressed birds was observed during aerial surveys, though partially oiled and distressed birds were observed by ground parties (see waterbird mortality section).

Conclusions

As of 19 April, 12,877 birds are known to have died in Washington and British Columbia from the Nestucca oil spill (preliminary tally of 9,309 in Washington - Don Kane, U.S. Fish and Wildlife Dept. pers. comm.). Total mortality may be much larger (Hope Jones 1970). Common Murres were the major victims in Washington (about 80%), and Common Murres and Cassin's Auklets were most abundant in British Columbia. World populations of those species are not threatened, but local populations are possibly at risk. Only 5620 Common Murres are estimated to breed in British Columbia, with the majority nesting on Triangle Island off the north tip of Vancouver Island (Rodway *et al.* in prep). Where those birds winter is unknown. Over 2.3 million Cassin's Auklets breed in the province, but where local populations winter is again unknown. Follow-up surveys during the breeding season will be required to assess the impact on local populations.

Oil from the spill spread along the entire west coast of Vancouver Island, and reached as far as the northern mainland coast, north of Bella Bella. Further information and long-term studies are needed before the

effects of a major spill can be fully assessed. We need to know:

1. Normal fluctuations in seabird breeding efforts and productivity in relation to environmental conditions. A rigorous sampling scheme is required to detect changes without having to resurvey the entire coastline.

2. Wintering areas for breeding birds from British Columbia colonies.

3. Populations and concentrations of waterbirds along the coast throughout the year.

4. Normal levels of beached bird mortality.

5. The proportion of total birds killed offshore represented by those that wash ashore.

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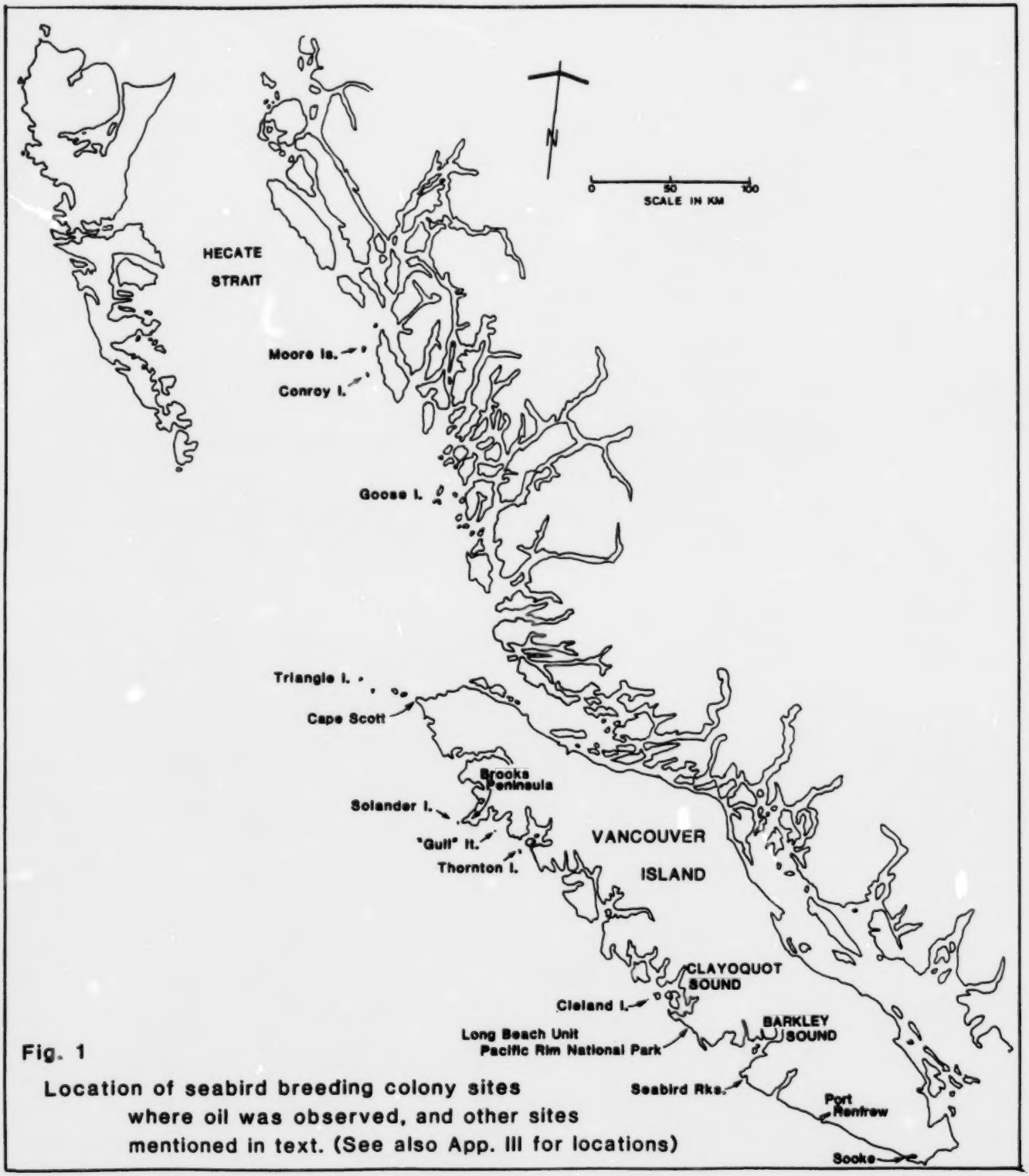


Fig. 1

Location of seabird breeding colony sites where oil was observed, and other sites mentioned in text. (See also App. III for locations)

Table 1. Dead, oiled birds found on the west coast of Vancouver Island, 3 January to 8 February 1989.

	JANUARY																										FEBRUARY					SITE TOTALS	AREA TOTAL
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	8		
Sooke to Port Renfrew:										12k																											12	12
																																						257
Port Renfrew to Pachena Pt.:																					50a																50	
Carmanah to Bonilla																																					20	
Dyac			20a																																		26	
Clo-oose									26a																												48	
Hope Pt. - Yuquot									48a									26d																			26	
Flanagan																		30d																			70	
Darling River														40a																							17	
unspecified														17																								
																																					135
Pachena Pt. to Cape Beale:																		4a																			4	
Pachena Point																	28a														3d						59	
Pachena Bay					36a													10	15d																		35	
Keeha Bay									10c										30p																		30	
Cleatus Beaches																		2																			7	
Seabird Rocks									5c																													
																																					165
Barkley Sound:																				15																	13	
Topaltos Beach									12p									2p																			2	
Kelby Island																																					14	
Benson Island										14k																			2								6	
Dicebox Island											4k																										42	
Broken Group				20			3	3	4	4	1		2		2					3a																	1	
Toquart Bay																			1a														6a				6	
Hayne Island																		3a	3a								14a										20	
Macoah Passage																											3a										3	
George Fraser Island																																	3a				3	
Beg Island																		14a	2a						1a		16a						2a				35	
south Ucluelet Inlet																											17a										20	
Stuart Bay										3p																												
																																					1435
Park Beaches:																																					255	
Florencia Bay	75	20	75	16	3	5	1	4	3	22	3	1	6	7	7	1	0	0	5b	0	0	0	0	0	0	0	0	0					2b				12	
Quisites Pt.																											10b										650	
Wickaninnish Beach	97	33	97	40	0	0	0	4	3	13	37	0	2	27	14	69	2	0	2	3	1	0	0	0	9	0	1	4									252	
Combers Beach	79	28	78	18	0	10	3	3	1	37	4	0	5	3	1		1	0				0	0	0	0	0	0	0	0	4	1						313	
Long Beach	50	55	60	39	3		2	1	1	15	29	0	0	20	23b		0	5b	0	0	1	0	0	0	0	0	0	0	1								145	
Schooner Cove	38	29	20	14	0	10	1	1	2	2	12	0	2	2	7	0	0	0	1b		0	1	0	1	0	0	0	2										
																																						1030
Portland Pt. to Sharp Pt.:											12p																										12	
Portland Point																		10b							5					5b							46	
Radar Beach		6		6	12	0			2							1b																1b					152	
Chesterman's Beach									150b							2c																					3	
Cleland I.									1c																												40	
Blunden and Bartlett I.							40a														30b																30	
Flores Island																																					745	
Vargas I. & Clayoquot Snd. area									625b*		58b				10b	60b	6b	4b																			10	
Kakawisc																																						

cont'd

Table 1. continued

	JANUARY																											FEBRUARY					SITE	AREA
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	8	TOTALS	TOTAL
Sharp Pt. to Cape Cook:																																						119
Nemais Cove															1p																						1	
Escalante Point												1c			7p	3e		1			28b															32	
Friendly Cove															1a																						1	
Calvin Ck. to Beano Ck.																					4e	2e		1e										1e			8	
Baje Point															2e	16e	2e	2e																	4e		26	
E of Tatchu Pt.																3p																					3	
Thornton Island												1c																									1	
Mission Group										3p			3e		2e	9e												1e									18	
Eyuquot										3d																											3	
'Gull' It. (Bunsby)																				5c																	5	
Acous Pen.																																			1e		1	
Jacobsen Pt.																				4p																	4	
Battle Bay															6p																				1e		7	
E of Clerke Pt.near Quinsam Bf.																				8e																	8	
W. end Brooks Pen.											1c																										1	
Cape Cook to Cape Scott:																																						65
Bay N of Beaver It.																				1c																	1	
Side Bay																		50f																			50	
Lawn Pt.																						1p															1	
Grant Bay																						5g															5	
E of Hanna Pt.																						1g															1	
Winifred Is.																						1c															1	
Guise Bay																						2g															2	
W of Guise Bay													1c									1g															2	
Hansen Lagoon																						1c															1	
Lanz Island																						1c															1	
TOTALS																																					3226	3226

a cumulative tally to 11 Jan/89.

Key to letter codes:

Code	Source of data
aa code	Pacific Rim National Park Wardens
a -	Nuu-chah-nulth Tribal Council
b -	Dave LeBlanc - Tofino volunteers
c -	Canadian Wildlife Service team
d -	Alan Berger
e -	D.F.O. - sea-otter surveillance team
f -	Kwakiutl Tribal Council
g -	Doug Swanston
h -	Al Whitney - Pacific Synergies Tours
j -	Carl Ostrom - P.R.P.
k -	Provincial Parks
m -	U.B.C. volunteers
p -	RPI database

Table 2. Species composition of a sample of dead, oiled birds found on the west coast of Vancouver Island from 3 January to 5 February 1989.

	Barkley Sound and south	Park[1] Beaches	Clayoquot[2] Sound area	North of Clayoquot	Unspecified Location	Totals
Common Loon		2				2
Pacific Loon	2	13	3	1	1	20
Red-throated Loon		2				2
Loon sp.				1		1
Western Grebe		1				1
Red-necked Grebe		5				5
Horned Grebe	2	2			1	5
Grebe sp.	1					1
Northern Fulmar	1	6	2		1	10
Short-tailed Shearwater	1					1
Double-crested Cormorant		1				1
Brandt's Cormorant		6	1		2	9
Pelagic Cormorant				1		1
Cormorant sp.	1	1				2
Black Scoter ♂		2				2
White-winged Scoter ♂	1	16		1	1	19
♀/imm		4				4
unsexed		3			1	4
Surf Scoter ♂		15	2		1	18
♀/imm		4	1		1	6
Scoter sp.	1	1				2
Harlequin Duck ♂		2				2
Oldsquaw ♂		1				1
Common Goldeneye ♂		1				1
Red-breasted Merganser		1				1
Duck sp.		3				3
Sanderling		1				1
Herring Gull - adult		1				1
Glaucous-winged Gull - adult	2	4			2	8
- 2nd yr.		1			1	2
- imm.	2	5				7
California Gull	1					1
Black-legged Kittiwake						
- adult		6				6
- immature		1				1
- unaged		2				2
Gull sp.	2	2			2	6
Common Murre	43	276	15	7	15	356
Pigeon Guillemot	2	3				5
Marbled Murrelet	4	5	1	1	1	12
Ancient Murrelet	1	16	1	3		21
Cassin's Auklet	21	202	29	10	12	274
Parakeet Auklet	4	8	1		2	15
Unidentified small alcids	1	5	1	1	1	9
Rhinoceros Auklet		1				1
Tufted Puffin	1	1	1			3
CAAU/MAMU					1	1
TOTALS (excluding unidentified pieces)	94	632	58	26	46	856
Unidentified pieces	1	10		1		12

1 Park Beaches - Florencia Bay to Schooner Cove.
2 Clayoquot Sound - Portland Point to Sharp Point.

Table 3. Species composition of daily samples of dead, oiled birds collected from Pacific Rim National Park beaches between Florencia Bay and Schooner Cove from 3 January to 1 February 1989. No samples were received on dates not listed.

	January															Feb.
	3-9	10	11	12	13	15	17	18	19	20	21	22	23	27	30	1
Common Loon					1										1	
Pacific Loon	8	1				1		2						1		
Red-throated Loon	2															
Western Grebe											1					
Red-necked Grebe	3				1	1										
Horned Grebe				1				1								
Northern Fulmar	5			1												
Cormorant sp.				1												
Double-crested Cormorant (*adult Alaska)	1															
Brandt's Cormorant	1				1				1		2	1				
Black Scoter ♂	1			1												
White-winged Scoter ♂	12				1			1								
♀/imm.	3					1										
unsexed	1					1	1		1					1		
Surf Scoter ♂	11	1				2					1					
♀/imm.	3							1								
Scoter sp.	1															
Harlequin Duck ♂				1		1										
Oldsquaw ♂	1															
Common Goldeneye ♂				1												
Red-breasted Merganser												1				
Duck sp.								3								
Sanderling	1															
Herring Gull - adult			1													
Glaucous-winged Gull																
- adult	1				1	1									1	
- 2nd year	1															
- immature		3		2												
Black-legged Kittiwake																
- adult	2					1		2			1					
- immature	1															
- unaged									2							
Gull sp.				1	1											
Common Murre	209			13	9	5		22	5	5	3	2	1		2	
Pigeon Guillemot		1		2												
Marbled Murrelet	4			1												
Ancient Murrelet	7			4	1			1		1	1					1
Cassin's Auklet	125			27	6	3	2	26	5	2	3	3				
Parakeet Auklet	5							3								
Unidentified small alcid pieces				1				3	1							
Rhinoceros Auklet	1															
Tufted Puffin (adult)															1	
Unidentified pieces	6			2				1				1				
Totals (excluding unidentified pieces)	410	6	1	57	22	17	3	65	15	8	12	7	1	2	5	1
cumulative # of species	19	20	21	24	25	25	25	25	25	25	26	27	27	27	27	27

Table 4. Numbers and species of partially oiled, dead birds identified in mortality samples collected from the west coast of Vancouver Island from 3 January to 3 February 1989.

Species	Date			Total
	3-18 Jan.	19-22 Jan.	23 Jan.-3 Feb.	
Pacific Loon	2	1	1	4
Common Loon			1	1
Loon sp.			1	1
Horned Grebe			1	1
Western Grebe		1		1
Brandt's Cormorant		1		1
Pelagic Cormorant		1		1
Harlequin Duck		1		1
Surf Scoter	1			1
White-winged Scoter	2	1	3	6
Sanderling	1			1
Herring Gull	1			1
Glaucous-winged Gull	5	4	1	10
Black-legged Kittiwake		3		3
Common Murre	3	7	2	12
Pigeon Guillemot	1			1
Marbled Murrelet	1		2	3
Ancient Murrelet			1	1
Cassin's Auklet		1		1
Tufted Puffin			1	1
Total	17	21	14	52

Table 5. History of visits and oil contamination on seabird breeding colony sites and known major wintering and migration areas for waterbirds and shorebirds on the northern west coast of Vancouver Island and the northern mainland coast of British Columbia resulting from the Nestucca oil spill. Initials of observers are the authors' except for: LH-Lee Harding, Environmental Protection Service; PO-Peter Olesiuk, Department of Fisheries and Oceans; ND-Norman Dale and KS-Karl Sturmanis - (Kwakiutl District Council). Other sources of data include Environmental Protection Service Operation Center Situation Reports (EPS sitrep), and Database (EPS database). Oil contamination was coded in 5 classes of increasing severity from 1 to 5. "Bags" refer to standard garbage bag size.

Site	Date	Type of Inspection	Observers/Source	Observations
Seabird Rocks	11/01/89	On foot	MSR, ML, RM	~5 bags on S beach area; 1 bag collected and left; few blobs on NE beach area.
	12/01/89	Cleanup	Contractor	4 bags collected, not removed.
	20/01/89		EPS sitrep	class 2 reported.
Baeria Rocks	13/01/89		Provincial Parks staff	no evidence of oil
	21/01/89		Provincial Parks staff	no evidence of oil
Starlight Reef	11/01/89	Low flyover	MSR, ML, RM	No visible oil.
Florencia It.	21/01/89	On foot	National park wardens	
Chesterman Beach	03/01/89		EPS sitrep	slight oil contamination reported
	13/01/89	Low flyover	MSR, ML, RM	Class 3 oiling along beach.
	14-22/ 01/89		EPS sitrep	volunteers dispatched and cleaning
	22/01/89		EPS sitrep	dime sized pieces reported
Cox Bay	14,17,18/ 01/89		EPS sitrep	volunteers dispatched and cleaning
Cleland I.	5/01/89		Provincial Parks staff	2 small surface slicks (1mx2m)
	11/01/89	On foot	Provincial Parks staff	spotty blobs (20-50cm), strip 1.5mx10m
	11/01/89	On foot	MSR, ML, RM, LH	Class 4 oiling on beaches and in crevices from SE beach (Campbell Bay) around W side of NW beach; blobs up to 1.0m in crevices; ~20 bags. Oil in tide pools; young seal oiled.
	13/01/89		Provincial Parks staff	oil present

Table 5. cont'd

Site	Date	Type of Inspection	Observers/Source	Observations
Cleland I. (cont'd)	18/01/89	On foot	MSR,JPS	Class 4 oil from 11/01/89 still present plus more recent oil in same area; oil has now washed up into the meadow on the south side; large blobs of oil have been moving through crevices, painting rocky areas with oil; ~25 bags estimated. No oil seen on N and E sides.
	20/01/89	Clean-up		15 bags collected; not removed.
	21/01/89	On foot	Provincial Parks staff	bags of oil and debris still to be removed
	22/01/89	On foot	MSR,ML	Oil patties still in crevices west of beach with cabin; scattered first sized blobs still on SE beach and crevice. Oil on rocks most SE of crevice - bags still to be removed.
	?/02/89	On foot	Tofino volunteers	volunteers dispatched and cleaning - collected 35 bags contaminated material.
Stubbs I.	07/01/89		EPS database	subtidal oil visible by SCUBA
	11/01/89		EPS database	cumulative to 11 Jan. 1.6km class 4 west coast.
	14/01/89		EPS sitrep	volunteers dispatched and cleaning
	15,19,20/01/89		EPS sitrep	cleanup
	28/01/89		EPS sitrep	buried blobs reported
	31/01/89		EPS sitrep	600 lbs. buried oil recovered
	01/02/89		MSR,ML,JPS	Small patches of sheen on upper areas on NE bay. patches of eelgrass on NW bay coated with oil (approx. 10% of total visible grass) tide only 3.7ft.
	02/02/89		EPS sitrep	contractor cleaning
	03/02/89		EPS sitrep	cleanup completed
McQuarrie Its.	13/01/89	Low flyover	MSR,ML,RM,PO	No visible oil.
	14/01/89	Low flyover	MSR,ML	Bit of sheen on water to SE.
	22/01/89	Low flyover	MSR,ML	No visible oil.
Clark I.	14/01/89	Low flyover	MSR,ML	No visible oil.

Table 5. cont'd

Site	Date	Type of Inspection	Observers/Source	Observations
Grassy I.	13/01/89	Low flyover	MSR, ML, RM, PO	No visible oil on island; bit of sheen on waters to N.
	14/01/89	Low flyover	MSR, ML	No visible oil.
	18/01/89		EPS database	blobs with seaweed, 1cm thick estimate 5 bags
	26/01/89		EPS database	class 3; 1-3cm, 1cm thick. 500m oil on beach, estimate 2 bags. Sheen coming off; in logs.
	02/02/89	On foot	JPS,LH	No visible oil.
Thornton I.	14/01/89	On foot	MSR, ML	Class 4 oiling on all S and W facing beach (~200m); most blobs fist to plate sized, few to 1.0m had come in on a recent tide, but was being buried by gravel and shell beach. Some oil patties wrapped in eelgrass, but most is solid oil. Some oil patties in tide pools and on rocks.
	18/01/89		EPS database	patches 2 ft; 2-3" thick; estimate 25-30 bags collected.
	20,21/01/89		EPS database	contractor cleaning
	21/01/89	Cleanup	contractor	40-50 bags collected; not removed.
	22/01/89	On foot	MSR, ML	Oil from beach has been cleaned up - bags still to be picked up - bags sitting on logs have been leaking over logs - recommend cutting and burning logs.
	25/01/89		EPS database	3 patches 1-10cm; 1cm thick; 100x500m estimate 2 bags filled bags leaking onto logs.
	02/02/89	On foot	JPS,LH	No sign of oil on beach between island section.
	8/02/89	On foot	K. Hebron	-fresh oil, cleaned up
Thomas I.	14/01/89	Low flyover	MSR, ML	No visible oil.
Bunsby Is. - "Gull" It.	14/01/89	On foot	MSR, ML	Class 4 oiling over 100m of beach; plate to 0.5m patties every 10m; some partially covered with shells and sand
	22/01/89	On foot	MSR, ML	Class 4 oil on both sides of beach area (plate size and up to 1.0m diam.) and onto adjacent rocky areas. 40 bags estimate; 1 dead oiled seaotter at tide line; 5 dead birds
	23/01/89		EPS sitrep	cleanup - 23 bags reported complete

Table 5. cont'd

Site	Date	Type of Inspection	Observers/Source	Observations
Bunsby Is. - "Gull" It. (cont'd)	25/01/89		EPS sitrep	10 bags reported - REET priority
	27/01/89		EPS database	300m class 4 estimate 20 bags cleanup - 23 bags??
Solander I.	13/01/89	Low flyover	MSR,ML,RM,PO	No visible oil. 3 or 4 oiled sealions in group of 65
Rowley Reefs	14/01/89	Low flyover	MSR,ML	No visible oil.
San Joseph Bay	15/01/89	Low flyover	MSR,ML,ND	One 1.0mx1.5m blob on low tide sand to south of estuary.
Sea Otter Cove	15/01/89	Low flyover	MSR,ML.ND	No visible oil.
	21/01/89		K.Hebron (EPS)	Oiled - estimate 5 bags.
	24/01/89	Low flyover	MSR,ML	Class 4 oiling all along beach at head of cove large "patties" in recent tide line and higher and mixed with drift, and on grass near estuary. estimate 20-25 bags.
	30/01/89	Cleanup	Coast Guard	40 bags removed.
Hansen Lagoon	15/01/89	Low flyover	MSR,ML.ND	No visible oil; some sheen on tidal pools on rock shelf to SE; sheen emanating from ball of kelp off entrance to lagoon.
	24/01/89	On foot	MSR,ML	Scattered coin-sized, few fist- and 1 plate-sized blob and stained eelgrass along high tide lines on beach at mouth of lagoon. 1/4 bag collected. Noted that sand is very mobile and drifts quickly over recent tidelines. Possibility that oil is being buried.
	31/01/89	On foot	MSR,ML	No visible oil on beach at mouth of lagoon. No visible oil on vegetation in lagoon from 15m fly-over.(however, snow covers most areas.)
Cox I.-S side	15/01/89	On foot on large mid-S beach; low flyover rest	MSR,ML,ND	No visible oil.
- S + W sides	17/01/89	Low flyover	MSR,ML	Two 10cm sized blobs on last high tide line on mid S beach; no visible oil on other areas.

Table 5. cont'd

Site	Date	Type of Inspection	Observers/Source	Observations
Cox I. (cont'd) - S. side	24/01/89	On foot on large mid-S beach; low flyover rest	MSR,ML	Scattered fist and plate-sized blobs in bays on either side of south point. estimate 2-3 bags of fist and plate-sized patties on recent high tide lines on ship-wreck beach.
Lanz I. - S side	15/01/89	Low flyover	MSR,ML,ND	No visible oil.
- S side	17/01/89	Low flyover	MSR,ML	No visible oil.
- S side	24/01/89	On foot	MSR,ML	estimate 1 bag of fist-sized blobs on 3rd beach W. of small islet on mid S side.
Beresford I.	24/01/89	flyover as close as possible	MSR, ML	No visible oil, but landing impossible so rocky shore not checked on foot.
Sartine I.	24/01/89	flyover as close as possible	MSR, ML	No visible oil, but landing not possible so rocky shore not checked on foot.
Triangle I.	15/01/89	On foot on W, S + NW beaches	MSR,ML.ND	1 5cm blob and 2 nickel-sized blobs found on recent high tide line in S bay - collected.
	24/01/89	On foot on W & S beach	MSR,ML	Small drop of oil and sheen in tide pool in South bay. one 8cm size blob of fresh oil found collected.
	31/01/89	On foot on W & S beach	MSR,ML,KS	South bay - mat of bull kelp partially coated with oil. Mat is 1m thick and 8m long - at low high tide line. One small fist-sized blob on last high tide line. Adult Glaucous-winged Gull oiled right side and belly.
Goose Is. -N. end W. beach	27/01/89	On foot	MSR,ML	One 10cm blob of oil wrapped with surfgrass on recent high tide line. collected.
-Anchorage beach	27/01/89	On foot	MSR,ML	Along 100m of beach, 3 oil patties found, One plate-sized, others smaller; all wrapped with eelgrass - collected.
Conroy Is.	27/01/89	On foot	MSR,ML	Lagoon at SE corner - one clump of oil 10cmx2cm on last high tide line - collected.
Whitmore Is.	27/01/89	On foot	MSR,ML	No sign of oil on beach between islands.

Table 5. cont'd

Site	Date	Type of Inspection	Observers/Source	Observations
Moore Is. -S. island west side	27/01/89	On foot	MSR,ML	On first south facing bay on west side of island,scattered fist-sized blobs of oil on E. side of bay.5 blobs seen and collected. Oil on tide line 2-3 days old. South end of island 1 fist and 1 coin sized blob collected.

Table 6. Bird sightings on helicopter surveys conducted along the west coast of Vancouver Island between 11 January and 2 February 1989. Species names and acronyms are listed in Appendix IV.

LOCATION	DATE	SPECIES																																				
		PALO	COLO	LOON SP.	ROGR	RNGR	YEGR	GREBE SP.	DCCO	RECO	PECO	CORM SP.	GBHE	TRUE	BRAN	CAGO	CAGO/ BRAN	GWTE	HALL	BOPI	AMWI	SCAUP	RNDU	BLSC	SUSC	WESC	SCOTER SP.	COGO	RNGO	GOLD SP.	BUFF	HOME	COME	RNME	HERG SP.
Pachena Bay	11/01	2	2		2		10																															
Keeha Bay	11/01				2	1																2								2							
Seabird Rocks	11/01										70											3								2							
Trevor Channel	11/01								25																													
Nootumis Bay	11/01												14	35																								
N end Hovell I. to N end Effingham I.	19/01				1		1					47															2			1							
N end Effingham I. to NW end Prideaux I.	19/01		2	3			2					73										18															
NW end Prideaux I. to Lyall Pt. (Pinkerton I.)	19/01			2								20	1			30						21	4	29	20	16				9						5	
Lyall Pt.-Stopper I.	19/01			6								22												52	20	4		4		5	3				4	
South of Haggis River	19/01		1	1								13		6										16	7	9									2	
Hecate Passage	11/01						120																	5		31							5				
	19/01											44																									
Starlight Reef	11/01																								20	5									1	
Uchulet Inlet	18/01			2			2																														
	19/01			3			10	6				20	2						30						30												
Florencia Bay	18/01																							28		22				5			3		13	
Hichamininh Bay	22/01																																				
"White" Island	17/01										1500																										
	18/01										2000																										
Covillaud Rocks	18/01										60																										
Grice Bay	18/01												35			200																					
	1/02												45	120	80						200								36								
Tofino Mudflats (just N side)	1/02											1						70			35			184					25	120							

Table 6. continued

| LOCATION | DATE | SPECIES | | |

Table 6. continued

LOCATION	DATE	SPECIES																														
				LOON				GREBE				CORM				CAGO/									SCOTER			GOLD					HERG
		PALO	COLO	SP.	HOGR	RNGR	WEGR	SP.	DCCO	RNCO	PBCO	SP.	GWFG	TRUS	BRAN	CACG	BRAN	GWTE	MALL	NOPI	AMWI	SCAUP	RNDU	BLSC	SUSC	WWSC	SP.	COGO	BAGO	SP.	BUFF	HOME	COME	RBME	SP.
mudflats S end E side Lemmens Inlet	1/02												1						400	160	320	5					3			8	100				
Templar Channel (incled. Wichanninish I.)	10/01										30																								
Stubbs I.	10/01										1		1		15							4								80				
	1/02												1												50						110				
Cleland I.	11/01									1	2																								
	10/01										1																								
	22/01																																		
Plover Reefs	11/01																																		
Bluedon I. (incled. Bartlett)	10/01																														1	2			
	22/01																																		
W side Flores I.	22/01																																		
south Sidney Inlet	22/01						90																												
Sharpe Pt.-Resqulat Pt.	13/01																																		
	14/01																																		
	22/01		4								100															1		6				1		
Resqulat Harbour	22/01		30		1	30		2				10	1									20			595			4		154		132		
Estevan Pt-Burdwood Pt.	13/01																																		
	14/01										100		2						4				3									2	2	1	
	22/01												1		25																				
	27/01														200																				
	2/02						3					4																							
Burdwood Pt.-Ewin Inlet W to Spanish Pilot Gp.	2/02																																		
Hootka Village to Tuquot Pt.	2/02																																		
Tuquot to Bajo Pt.	13/01	birds not surveyed																																	
	14/01										100																								
	17/01										60																						1		
	22/01										80																								
	2/02		5				24					4									12				30					11					
Bajo to Perrez Pt.	13/01												2																						
	22/01											20						4	127									30		40		20			
	2/02						8																												
Perrez Pt. to Yatchu Pt.	13/01																																1		
	22/01											50																							

Table 6. continued

LOCATION	DATE	SPECIES																												
		BRCE SP.	BAEA	BTHA	HAVE	PEFA	RBPL	BLOY	BLYU	SURF	SAND	DUNL	CALIDRIS SP./ SURF	CAGU	REGU	GUGU	GULL SP.	COHU	PIGU	HANU	TOTAL BIRDS	SEA HAIR OTTERSEAL	NORTHERN SEALION	ORCA	WOLF	RACCOON
mudflats S end E side Lemmens Inlet	1/02												260	30		10					1297					
Tsuplar Channel (includ. Vickaninish I.)	10/01																				30					
Stubbs I.	10/01												230								331					
	1/02						10				6	800				45					1022					3
Cleland I.	11/01	3						6	1						2	3					18		5			
	18/01							2	1							3					7					
	22/01	1														15					16					
Flower Reefs	11/01																						60			
Bleaden I. (includ. Bartlett)	18/01															70					73					
	22/01																									
W side Flores I.	22/01												40								40					
south Sidney Inlet	22/01																				90					
Sharpe Pt.-Hesquiat Pt.	13/01																						20			
	14/01																				0		20			
	22/01	1											80			55					240		55			
Hesquiat Harbour	22/01												80								1059					
Estevan Pt-Burdwood Pt.	13/01																				0		200			
	14/01	6											20	20							160		150			
	22/01												25								51		150			
	27/01							6					30								236					
	2/02												36				550	1			584		60			
Burdwood Pt.-Ouin Inlet W to Spanish Pilot sp.	2/02							7													7					
Hootka Village to Toquot Pt.	2/02																1				1					
Toquot to Bajo Pt.	13/01																					2	60			
	14/01																				180					
	17/01															40					101	4				
	22/01												3								83					
	2/02		2						1								35	14			130					
Bajo to Ferrer Pt.	13/01																				2				3	
	22/01	3						6					15	70		50					393					
	2/02																				0					
Ferrer Pt. to Yatchs Pt.	13/01	2						13	16												32					
	22/01																				50					

Table 6. continued

LOCATION	DATE	SPECIES																														
		PALO	COLO	LOON SP.	HOGR	RNGR	GREBE WEGR	SP.	OCCO	HECO	PECO	CORM SP.	GBHE	YBUS	BRAN	CAGO/ CACG	BRAN	GWFG	HALL	HOPI	ANWI	SCAUP	RADU	BLSC	SUSC	WWSC	SCOTER SP.	COGO	BAGO	GOLD SP.	BUFF	HOME	COME	RBME	HERG SP.
Huchatlitz Inlet W of Lord I.	2/02			42			84	2				1	2										10				1			40	10		5	10	
Hary Basin	2/01			1								1	2												10	200				10			10		
Inner Basin Head Huchatlitz Inlet	2/02						10							3		3		20		3										10			5	3	
W of Huchatlitz village	2/02			3			1					116																							
Zeballos	2/02													6						16															
McQuarrie It.	14/01																																		
	22/01																			10					15										
Grassy It.	14/01										1																								
	22/01											25																							
Clarke I.	14/01										30																								
Thornton I.	14/01											700																							
	22/01									610																									
Chanis Bay	14/01																			6								10			1				
Mission Group and vicinity	22/01									300															60										
Clanninick Cove	13/01						70																												
MacLean I.-Malksope Pt.	14/01																								20										
Thomas I.	14/01																										30								
	22/01																								70										
Bunsby Is. (includ. "Gull" Islet)	14/01																								200								8		
	22/01						30					20													195						8	3	1		
	2/02																								1050										
Bottle Bay	14/01				1																												3		
Acous Pen. (includ. Cattle I.)	14/01																								20	320					2				
O'Leary It.	22/01																																		
Jacobsen Pt.-Cape Cook	13/01												4																						
	14/01												1																						
	2/02							5				30																							
Solander I.	13/01										1																								

Table 6. continued

LOCATION	DATE	SPECIES																												
		DUCK SP.	BAEA	BTHA	BAVE	PEFA	RBPL	BLOY	BLTU	SURF	SAND	DUBL	CALIDRIS SP./ SURF	CACU	BECU	GUCU	GULL SP.	COHU	PICU	HAHU	TOTAL BIRDS	SEA OTTER	HAIR SEAL	NORTHERN SEALION	ORCA	WOLF	RACCOON
Hechatlitz Inlet W of Lord I.	2/32	4											15				75				301						
Mary Basin	2/01	30																			264						
Inner Basin Head Hechatlitz Inlet	2/02	6															10				75						
W of Hechatlitz village	2/02								3								150	1			270						
Seballos	2/02																				22						
McQuarrie It.	14/01												3		5						8						
	22/01									12											37			1			
Grassy It.	14/01	5	3					1	2				15		2						29		20				
	22/01		1						6				130								162		40				
Clarke I.	14/01								4	25											59						
Thornton I.	14/01								1				50		40						791		2				
	22/01																				610						
Chasis Bay	14/01																				17						
Mission Group and vicinity	22/01														30			25			615						
Clanninick Cove	13/01																				70						
MacLean I.-Walkeape Pt.	14/01								75												95	2					
Thomas I.	14/01							2													32						
	22/01																				70						
Lansby Is. (includ. "Gull" Islet)	14/01		1																		209						
	22/01		2						8				70								337						
	2/02																				1050						
Battle Bay	14/01									64											68						
Acous Pen. (includ. Cattle I.)	14/01		1					3													346	1					
O'Leary It.	22/01																							100			
Jacobsen Pt-Cape Cook	13/01																				6				4		
	14/01														100						101						
	2/02																				35						
Solander I.	13/01																				1			65			

Table 6. continued

LOCATION	DATE	SPECIES																														
			LOON				GREBE				CORM				CAGO/									SCOTER			GOLD					MERG
		PALO	COLO	SP.	RDLO	BLLO	HOGR	EAGR	WEGR	SP.	DCCO	BLCO	PECO	SP.	GBBE	TRUE	BRAN	CACO	BRAN	GWTE	HALL	MOPI	ANWI	SCAUP	RUDU	BLSC	SUSC	WESC	SP.	COGO	BAGO	SP.	BUFF	HOME	COME	RBME	SP.
Cape Cook to Pt. E of Hackett I.	22/01																																	3		
Estuary E of Orchard Pt.	22/01															3																12	6	1		
Klaskish Inlet	22/01		3						60																		30					19	1			
Napier Pt. to Heater Pt.	22/01													20																						
Morris Bk.	22/01												150															6								
Scouler Entrance to head Klaskino Inlet	22/01	5			1	3	15																									6				
Keith River mouth	22/01																			20	20											2		3		
Side Bay	22/01						9																													
Lava Pt.	14/01																											20				4	2			
Restless Bight	15/01																																			
Bowley Reefs	14/01												30																							
Eagrine Hbr.	15/01															13																				
Quatsino Narrows	15/01																																			
Raft Cove	15/01																																			
San Josef Bay	15/01												4								23															
Sea Otter Cove	15/01																				200									3		20				
(includ. Winifred I.)	24/01			1											1						60			15			25					3		2		
Lowrie Bay	24/01									9																								1		
Hansen Lagoon	15/01														1	32		150			20		60									4				2
	24/01														1	21		150			116											72	1	3		
	31/01			3											1	25		110		35	135											24				
Cape Scott to Cox I.	15/01												2															210								
	17/01																											180								
	24/01																											410								
	31/01																											80								
S side Cox I.	15/01												20																							
	17/01																																			
	24/01																											12								
	31/01													100																						

Table 6. continued

| LOCATION | DATE | SPECIES | | |

Table 6. continued

LOCATION	DATE	SPECIES																														
		LOON				GREBE				CORM				CAGO/										SCOTER			GOLD				XERG	
		PALO	COLO	SP.	ROCK	RNGR	HEGR	SP.	DCCO	RECO	PECO	SP.	GBHE	TRUS	BRAN	CAGO	BRAN	GWTE	MALL	BOPI	AMWI	SCAUP	HARU	HLSC	SUSC	WSSC	SP.	COGO	BAGO	SP.	BUFF	HOME	COHE	RBME	SP.
Cox I. to Lasz I.	15/01																								60									
	17/01																								60									
	24/01																								7									
S side Lasz I.	15/01										35																							
	24/01																																	
	31/01																								60									
Beresford I.	15/01										1														1									
	24/01																																	
Beresford - Sartine I.	15/01										2																							
	24/01																																	
Sartine I.	15/01																								25									
	24/01																								4									
Sartine I.-Triangle I.	24/01		1								3																							
Triangle I.	15/01										1																							
	24/01										120																							
	31/01										80														35									
N end Goletas Ch.	15/01																						4		6	32	8							
Cape Sutil-Cape Scott	15/01					5					12																							
N end Hope I.	15/01																										3							
N side Calvert I.	27/01										1	9													3	65							1	
N end Clavert I. through to narrows at N end Kildidt Sound	27/01							101																										
Hunter Channel to Lasa Passage	27/01										1	2													6									
Hunter Channel N of Lasa Passage	27/01		1																							27					2		2	1
Moore Is.	27/01		2								15		1													80									
Whitmore Is.	27/01																									46									
Whitmore to Byers Is.	27/01										2																							
Byers Is.	27/01										5		2													8									
Byers to Conroy Is.	27/01																																	
Conroy I.	27/01																																	

Table 6. continued

| LOCATION | DATE | SPECIES | | |

Table 6. continued

LOCATION	DATE	SPECIES																													
		LOON			GREBE			COOR				CAGO/										SCOTER			GOLD					MERG	
		PALO	COLO	SP.	ROGR	RNGR	WEGR	SP.	OCCO	RECO	PECO	SP.	GWFG	TRUS	BEAN	CAGO	BRAN	CITE	HALL	BOPI	AMWI	SCAUP	RNDU	BLSC	RUDU	WRDC	SP.	COGO	BAGO	SP.	BUFF	HOME	COME	RNER	SP.
Goose I. (W side)	27/01																	7																
Goose I. (lagoon)	27/01															120		14						5						1			2	
Duck I. (W side)	27/01																																	
Gosling Rocks	27/01										190														2	20					3			

Table 6. continued

LOCATION	DATE	SPECIES																								
		DUCK SP.	BARA	RTHA	HARE	PEFA	RBPL	BLOT	BLTU	SURF	HARD	BOWL	CALIDRIS SP./ SURF	CAGU	HEGU	GWGU	GULL SP.	COMM	PIGU	HERG	TOTAL BIRDS	SEA OTTER	HAIR SEAL	NORTHERN SEALION	ORCA	WOLF	RACCOON
Goose I. (W side)	27/01							6	15											20						
Goose I. (lagoon)	27/01	50																		192						
Duck I. (W side)	27/01							5	40							25				70						
Cooling Rocks	27/01							15	30							25				205		4				

Appendix I. Observations of oil by CWS assessment team at locations other than sensitive bird sites. Oil contamination was coded in 5 classes of increasing severity from 1 to 5. "Bags" refer to standard garbage bag size.

Date	Location	Type of Inspection	Observations
11/01/89	Pachena Bay	Low flyover	Slick and oiled debris on water in cove at NW corner of bay.
	Keeha Bay	On foot	300m of class 4 oiling; patties up to 1.0m; oiled debris along high tide line and on drift logs (photos-M.L.).
	Loudoun Channel	Flyover	Extensive sheen (2kmx100m) through channel south of Starlight Reef.
13/01/89	Goldmine Beach	Low flyover	Class 3 oiling along and above last high tide line.
	Wickaninnish Beach SE of lodge.	Low flyover	Small slick on water off beach.
	N. end of Long Beach	Low flyover	4 slicks (150mx5m ea.) and 2 slicks (5mx3m) 200m offshore.
	Mozer Pt.-Vargas I.	Low flyover	Small slick and sheen on water.
	Ahous Bay-Vargas Is.	Low flyover	Small slick and sheen on water.
	N. of Vargas I.	Low flyover	Small slick offshore at 0900hrs; ribbon of sheen at 1640hrs.
	Sharp Point	Low flyover	Sheen on water south of point (500mx15m).
	Escalante Point - 1.5km S of pt.	Low flyover	Extensive sheen (1kmx300m) with scattered brown blobs - outside tidal rocks at 1200hrs; moved over tidal areas at 1630hrs.
	Twin Islands	Low flyover	Small ribbon of sheen 200m offshore.
	High Rocks	Low flyover	Small pockets of sheen on water off beach.
13/01/89	Tatchu Point	On foot	Scattered fist- to pie-sized blobs along high tide line (4-5 bags along 500m walked); coin-sized blobs on surfgrass on tidal rock shelves - sheen emanates from these.
	Brooks Peninsula		
	- Clerke Point	Low flyover	Sheen and small blobs on tide pools.
	- SW end N of of Clerke Point	On foot	Class 5 oiling for 100m; Class 4 oiling for 1125m (photos-ML). Class 5 contamination located on the south point of small gravel bay mid-way along the outer face of the Brooks Peninsula. 50°5'24"N 127°51'W. Class 5 oil - approximately 30 barrels of oil estimated in strip 100m long and 4-6" thick - just at and below drift log line on large boulders and on rock shelf. Class 4 oiling continues SE for at least 400m; patties are large - over 1 to 2m in diameter - draped over rocks - can be rolled up off rocks at present. Class 4 oiling also continues about 500m north along rocky shore to small beach where oil is present as

Appendix I. cont'd

Date	Location	Type of Inspection	Observations
			class 4 for a total of about 225m on both sides of the creek. Oil not present in high impact surf zone in middle of bay. The oiling is recent on the last 2 or 3 high tide lines. Oil also on and under drift but much is readily cleanable. Pictures taken. Sample of oil taken.
14/01/89	Escalante Pt. - 1.5km S of pt.	On foot	Class 4 oiling for 300m walked; presumed to be more extensive; 0.5-1.0m sized patties every 5m.
	Point and 180' it. ESE of Thomas I.	Low flyover	Class 4 oiling for 1km along shore; 1.0m blobs on beach rocks and in water within kelp zone; sheen emanating from all blobs in water; blobs in water are brown and on surface.
	Acous Peninsula - E side.	Low flyover	Class 4 oiling for 200m - scattered patties on small sized gravel beach
	Cuttle Its. - N islet (125')	Low flyover	Class 4 oiling on NE beach and patties in kelp and offshore of NW bay.
14/01/89	Brooks Peninsula W end N of Clerk Pt.	On foot	Class 5 stretch as observed on 13/01/89; some drift logs rolled over some parts of blob.
	Lawn Point	Low flyover	Scattered plate-sized patties on W and S beaches (1-2 bags); sheen on E beach.
	60' islet N of Lawn Pt.	Low flyover	Two 1m-sized patties observed on N end and middle beach.
15/01/89	Guise Bay	On foot	12 patties (0.5m-1.0m) washing in on rising tide; some plate-sized patties and frequent small clumps wrapped with surfgrass and other debris along last high tide line.
	Small bay just W of Guise Bay	Low flyover	Patties visible along last high tide line.
	Lowrie Bay	Low flyover	No visible oil, sheen on tidal pools along rocky area E of bay.
	Cape Palmerston	Low flyover	Class 4 oiling for 20m, patties up to 1.5m thrown onto driftwood; sheen on N side of cape.
	Cape Palmerston to Raft Cove	Low flyover	Pockets of Class 4 oiling in pocket bays; sheen along rocky intertidal areas.
	Raft Cove	Low flyover	Class 4 oiling for 300m; patties up to plate-size frequent on sand along lower tidal areas.
	Grant Bay	On foot	Class 4 moderate oiling along recent high tide line and lower on beach; patties up to 0.5m size.
	Restless Bight	Low flyover	No visible oil.

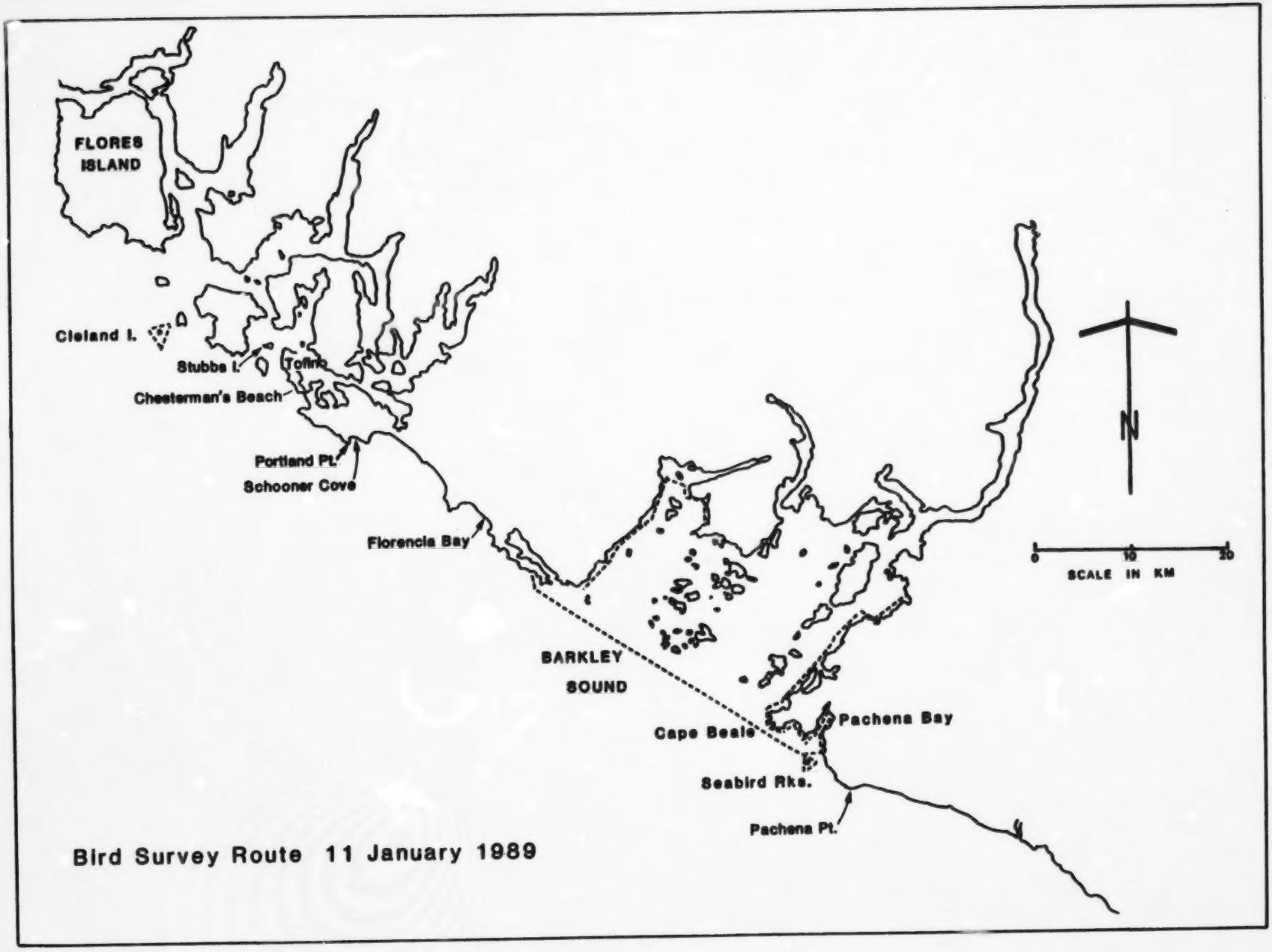
Appendix I. cont'd

Date	Location	Type of Inspection	Observations
17/01/89	Guise Bay	Low flyover	No visible oil - surf pounding at high tide line.
18/01/89	Blunden I.	Low flyover	Small mid-SW beach - oil on high tide line on sand; 1-2 bags estimated.
	Vargas I. - - Ahous Bay	Low flyover	Scattered oil patties to plate-sized.
22/01/89	Brooks Pen.-bay S of pt. NE of Guilliams I.	Low flyover	scattered patties to 0.3m - 2 bags estimated.
	Brooks Pen.-bay S of Orchard Pt.	Low flyover	scattered bit of oil fouled eelgrass
	Bays N. of Bonner Islet	on foot	scattered fist - sized patties in east bay. plate - sized patties in next bay west. 2 bags estimated; 1 dead bird.
24/01/89	Lowrie Bay - beach near north end	Low flyover	oil blobs to 0.5m - mostly plate-sized 5-10 bags estimated.
	Winnifred Is.	Low flyover	oil on beach joining islands - few fist-sized blobs and mixed with seaweed 1 bag estimated.
02/02/89	Brooks Peninsula W end N of Clerk Pt.	On foot	Area with previous class 5 oiling now has oil spread out and splattered on rocks and logs.

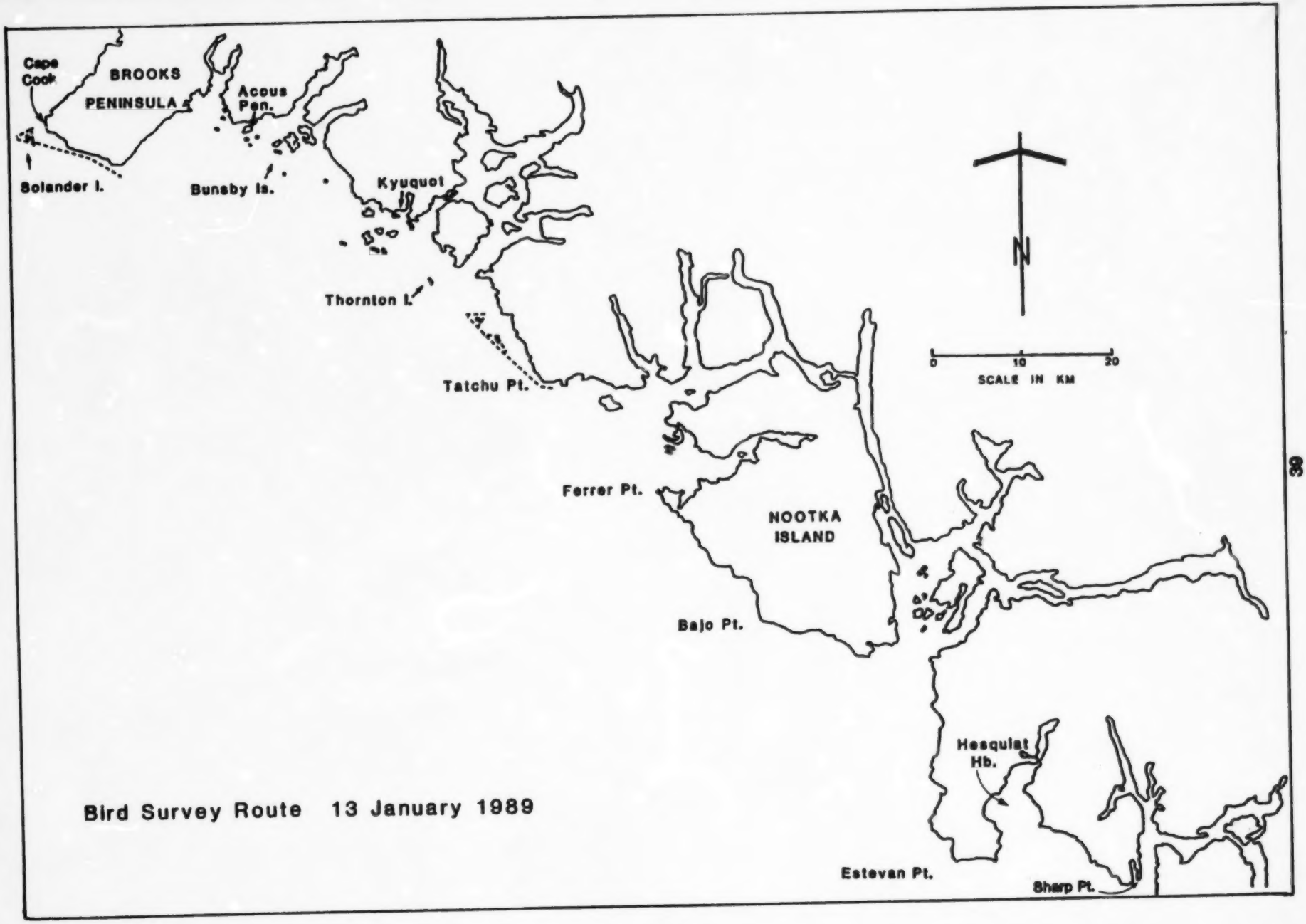
Appendix II. Time and weather conditions on helicopter surveys.

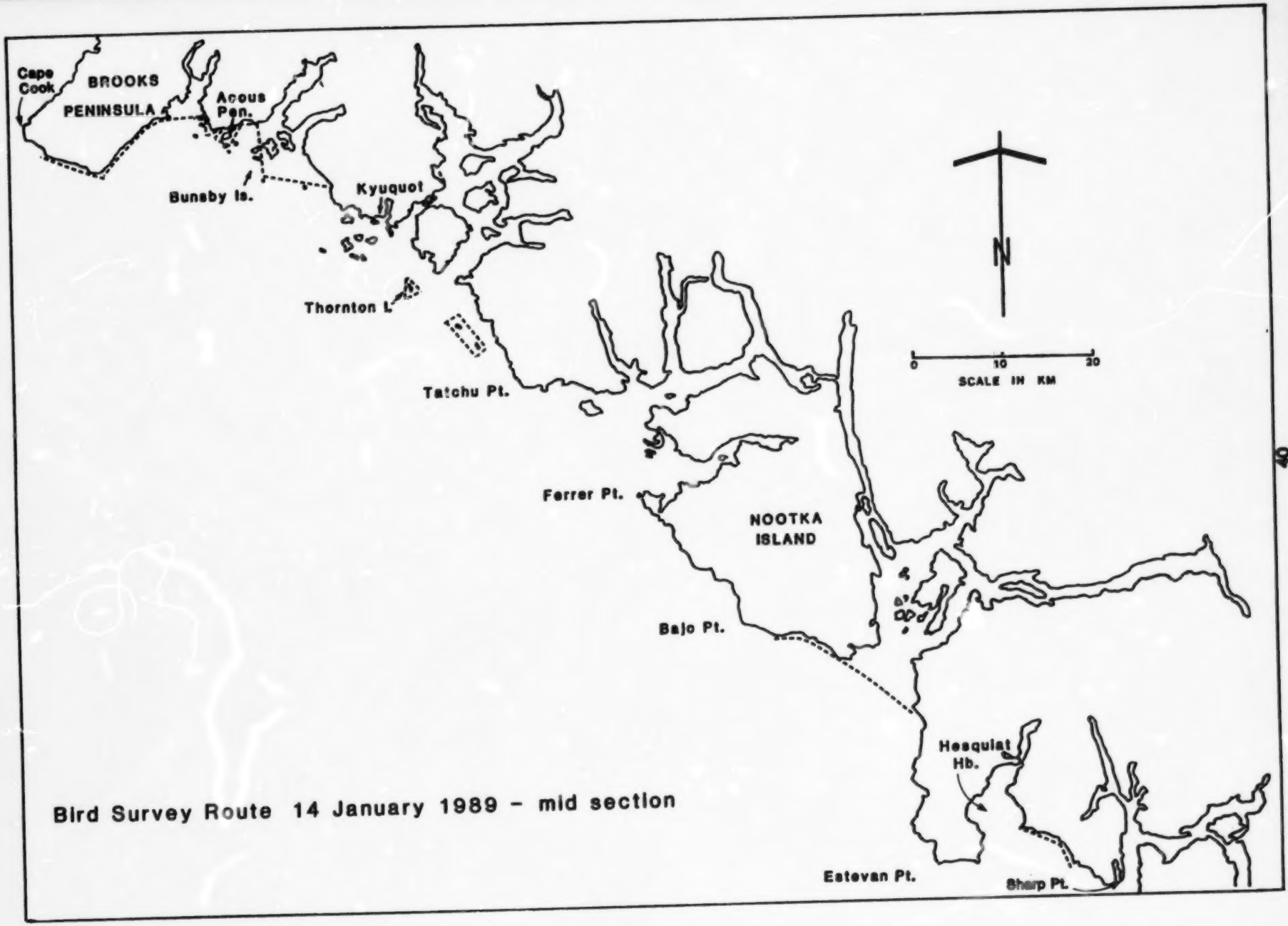
Date	Time	Wind	Visibility	Cloud condition
11/01	0910-1500	Light	Good	High overcast
13/01	0830-1700	Minimal, except for rainsqualls	Minimal in showers, otherwise good	Brief, frequent, isolated heavy showers otherwise sunny
14/01	1000-1535	Light	Good	High overcast
15/01	0840-1600	Building SE	5-10 miles	Low cloud showers, impending storm
17/01	0920-1000	Strong-gale force SE	1-5 miles	Rain, storm building
18/01	1455-1715	Light	Good	Scattered cloud
19/01	0934-1030	Moderate	Very good	Partially cloudy
22/01	0925-1445	Light	Excellent	Clear and sunny
24/01	0915-1320	Strong SE	Good	Overcast with showers
27/01	0830-1515	Moderate to strong SE	Poor to moderate	Low clouds and rain
31/01	1100-1245	Light	Good except in snowflurries	Sunny, with scattered snow squalls
01/02	1500-1720	Strong NE	Good-water rough	Sunny
02/02	1100-1745	10-20 knots	Very good	Sunny

Appendix III. Flight line maps of bird surveys conducted on the west coast of Vancouver Island between 11 January and 2 February 1989.

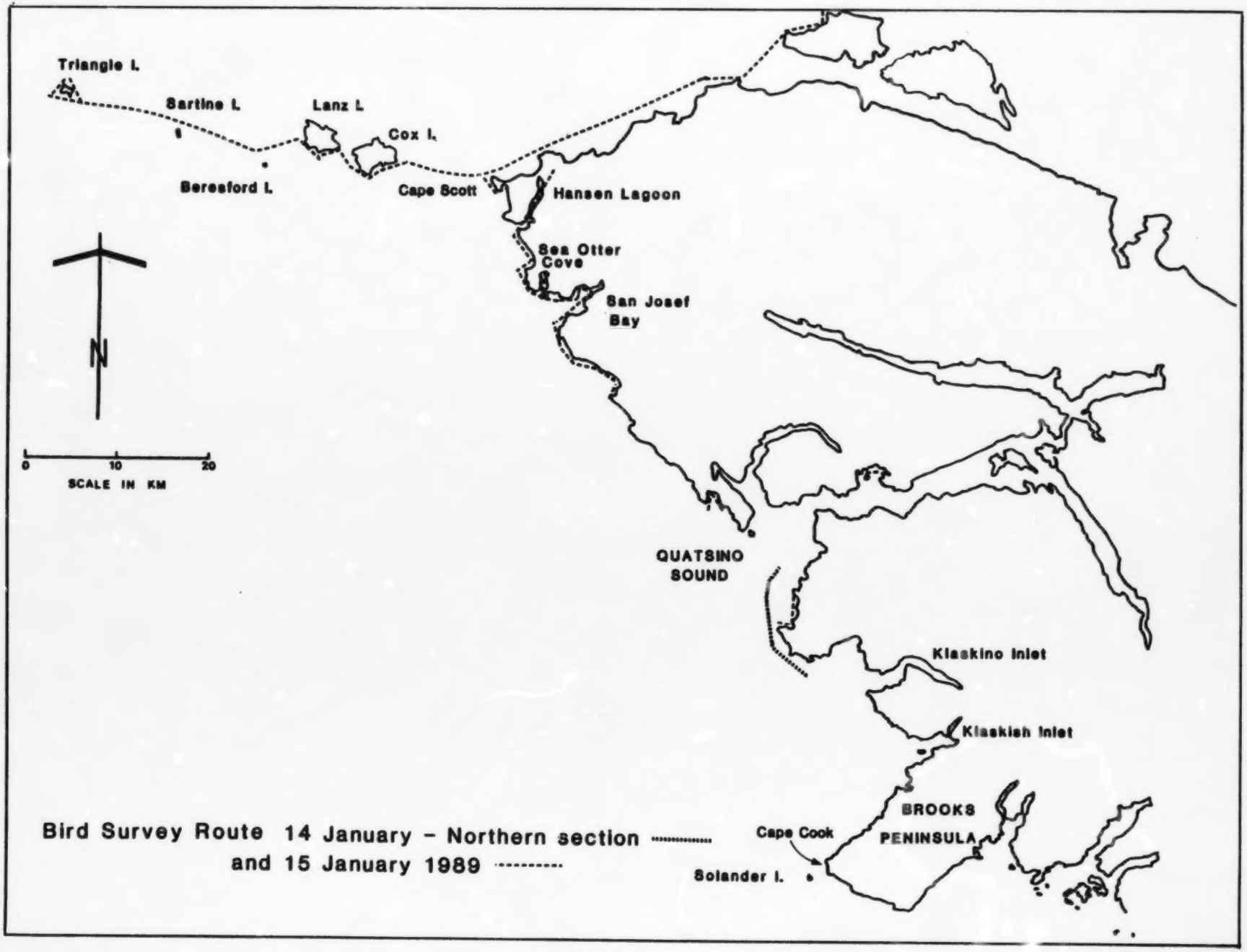


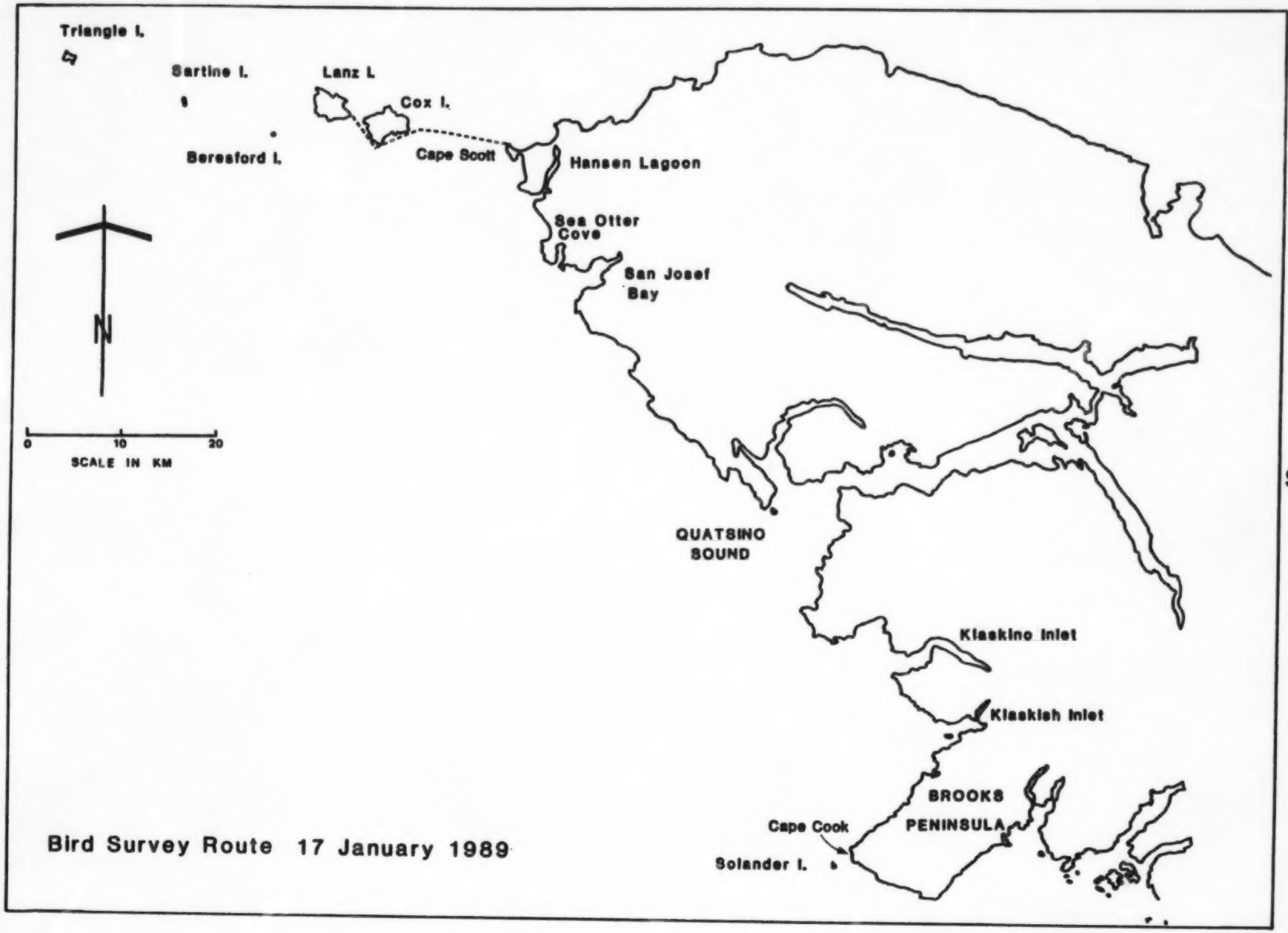
Bird Survey Route 11 January 1989


Cape Cook
BROOKS PENINSULA
Acous Pen.
Solander I.
Bunsby Is.
Kyuquot
Thornton I.
Tatchu Pt.
Ferrer Pt.
NOOTKA ISLAND
Bajo Pt.
Hesquiat Hb.
Estevan Pt.
Sharp Pt.
N
0
10
20
SCALE IN KM
Bird Survey Route 13 January 1989

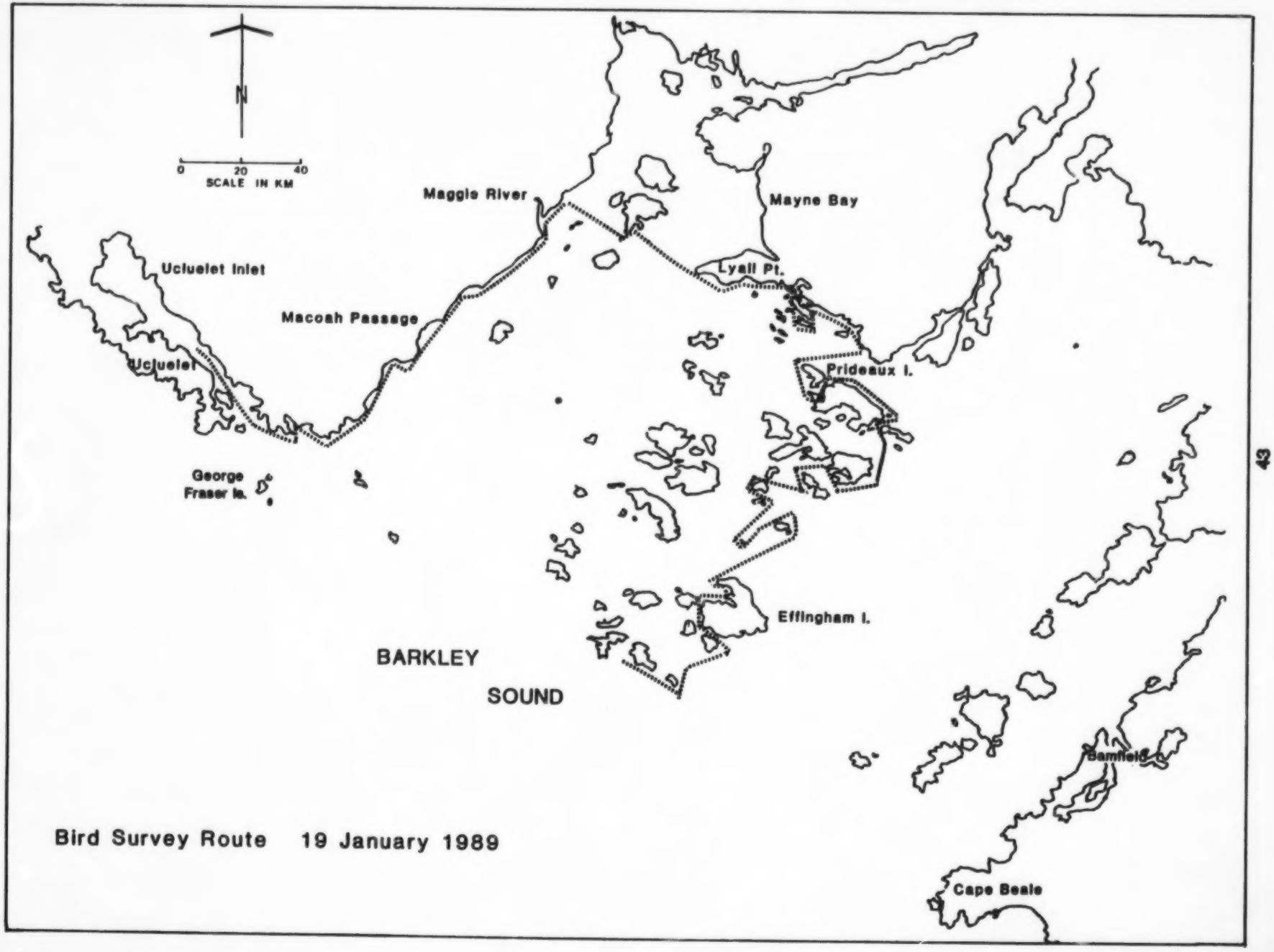


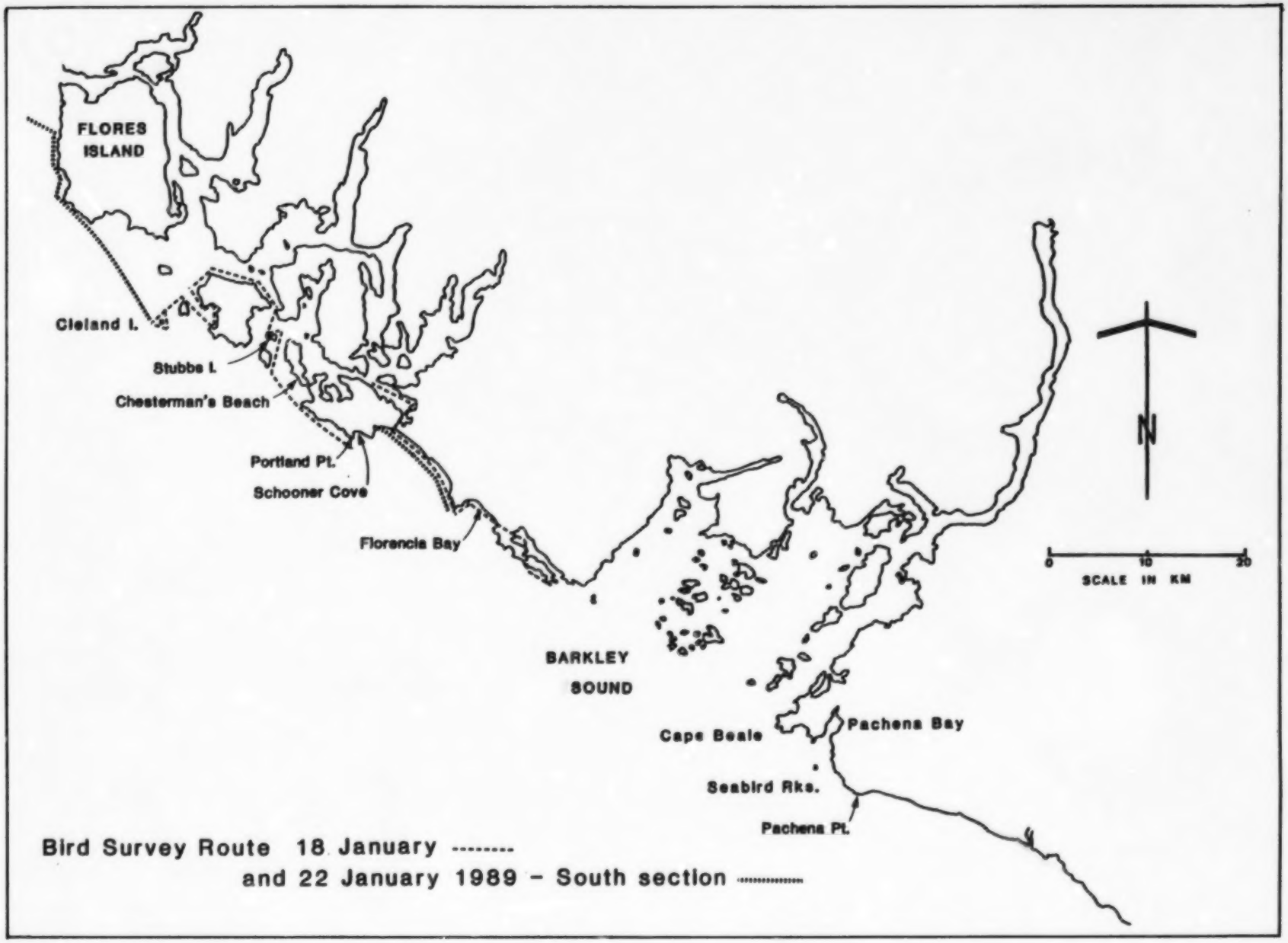
Bird Survey Route 14 January 1989 - mid section

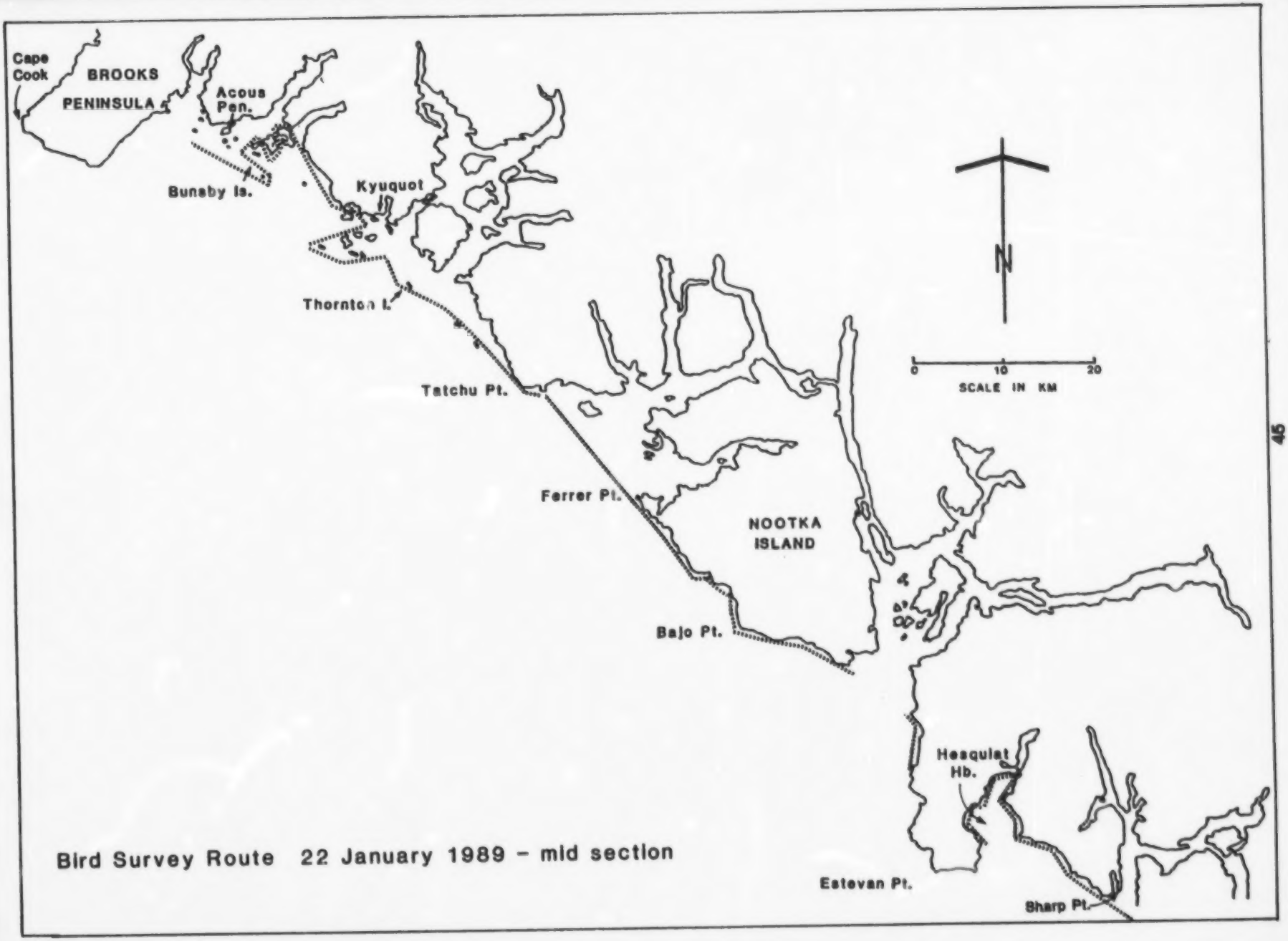

Triangle I.
Sartine I.
Lanz I.
Cox I.
Beresford I.
Cape Scott
Hansen Lagoon
Sea Otter Cove
San Josef Bay
N
0
10
20
SCALE IN KM
QUATSINO SOUND
Klaskino Inlet
Klaskish Inlet
BROOKS PENINSULA
Cape Cook
Solander I.
Bird Survey Route 14 January - Northern section
and 15 January 1989



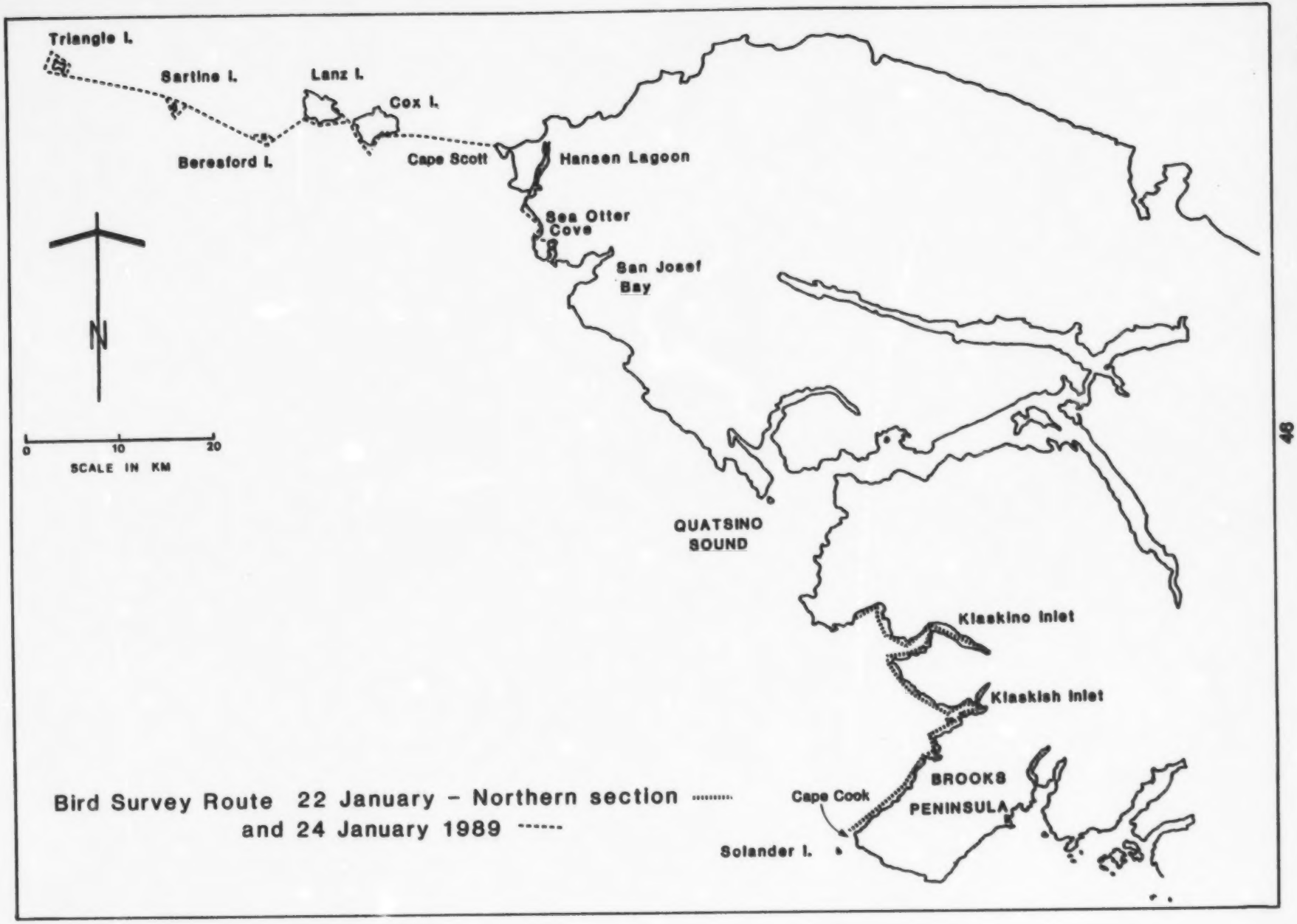
Bird Survey Route 17 January 1989

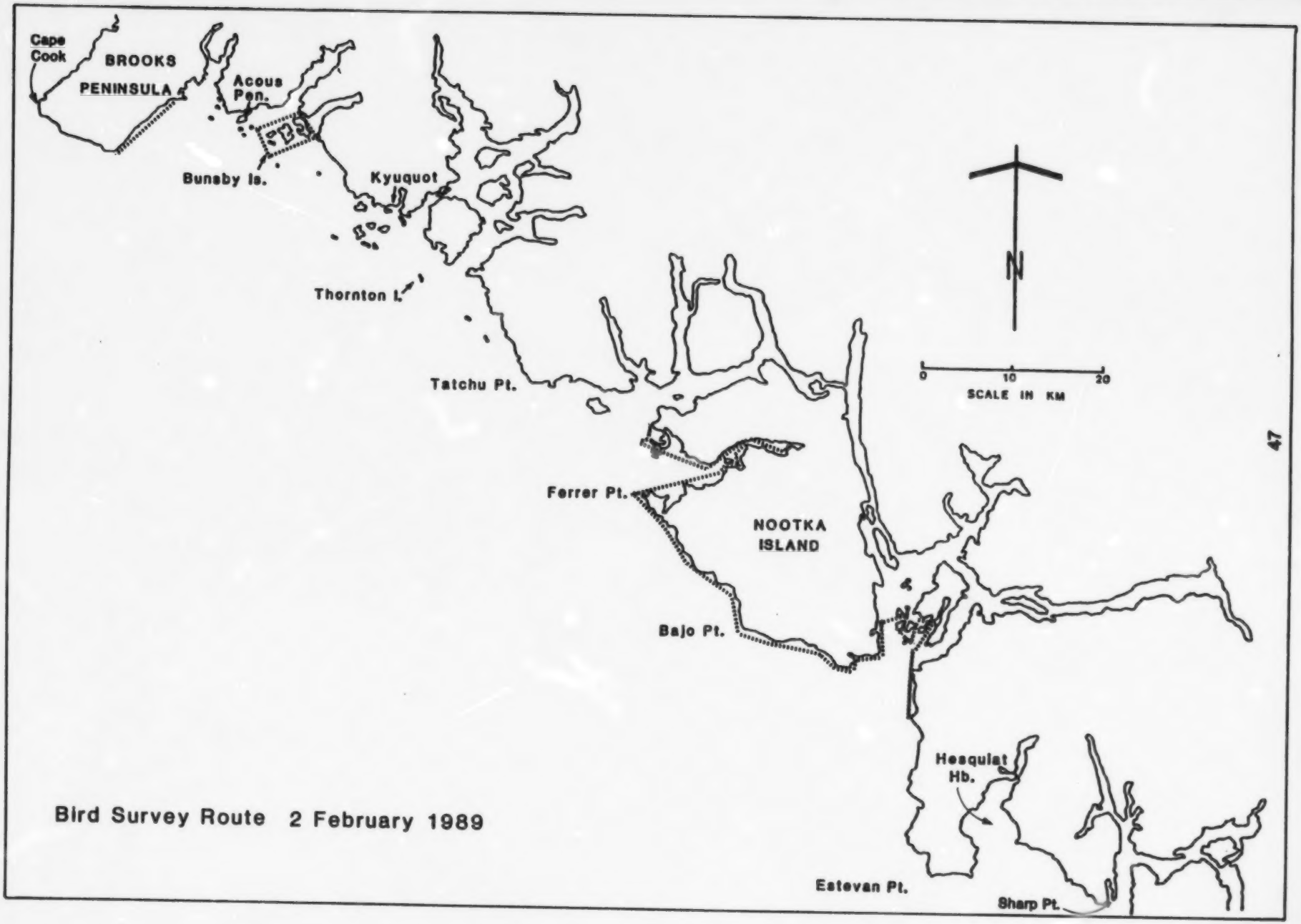

N
0 20 40
SCALE IN KM
Maggie River
Mayne Bay
Lyall Pt.
Ucluelet Inlet
Macoah Passage
Ucluelet
Prideaux I.
George
Fraser Is.
Effingham I.
BARKLEY
SOUND
Bamfield
Cape Beale
Bird Survey Route 19 January 1989


FLORES
ISLAND
Cleland I.
Stubbs I.
Chesterman's Beach
Portland Pt.
Schooner Cove
Florencia Bay
BARKLEY
SOUND
Cape Beale
Pachena Bay
Seabird Rks.
Pachena Pt.
N
0
10
20
SCALE IN KM
Bird Survey Route 18 January --------
and 22 January 1989 - South section ....



Bird Survey Route 22 January 1989 – mid section


Triangle I.
Sartine I.
Lanz I.
Cox I.
Beresford I.
Cape Scott
Hansen Lagoon
Sea Otter Cove
San Josef Bay
N
0
10
20
SCALE IN KM
QUATSINO SOUND
Klaskino Inlet
Klaskish Inlet
BROOKS PENINSULA
Cape Cook
Solander I.
Bird Survey Route 22 January - Northern section .....
and 24 January 1989 ------



Bird Survey Route 2 February 1989

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APPENDIX IV. Index to species names and acronyms (following Campbell and Harcombe 1985).

Birds:		
Pacific Loon	*Gavia arctica*	PALO
Common Loon	*G. immer*	COLO
Horned Grebe	*Podiceps auritus*	HOGR
Red-necked Grebe	*P. grisegena*	RNGR
Western Grebe	*Aechmophorus occidentalis*	WEGR
Double-crested Cormorant	*Phalacrocorax auritus*	DCCO
Brandt's Cormorant	*Phalacrocorax penicillatus*	BRCO
Pelagic Cormorant	*P. pelagicus*	PECO
Great Blue Heron	*Ardea herodias*	GBHE
Trumpeter Swan	*Cygnus buccinator*	TRUS
Brant	*Brant bernicla*	BRAN
Canada Goose	*B. canadensis*	CAGO
Green-winged Teal	*Anas crecca*	GWTE
Mallard	*A. platyrhynchos*	MALL
Northern Pintail	*Anas acuta*	NOPI
American Widgeon	*Anas americana*	AMWI
Harlequin Duck	*Histrionicus histrionicus*	HADU
Black Scoter	*Melanitta nigra*	BLSC
Surf Scoter	*Melanitta perspicillata*	SUSC
White-winged Scoter	*M. fusca*	WWSC
Common Goldeneye	*Bucephala clangula*	COGO
Barrow's Goldeneye	*Bucephala islandica*	BAGO
Bufflehead	*Bucephala albeola*	BUFF
Hooded Merganser	*Lophodytes cucullatus*	HOME
Common Merganser	*Mergus merganser*	COME
Red-breasted Merganser	*M. serrator*	RBME
Bald Eagle	*Haliaeetus leucocephalus*	BAEA
Red-tailed Hawk	*Buteo jamaicensis*	RTHA
Peregrine Falcon	*Falco peregrinus*	PEFA
Black-bellied Plover	*Pluvialis squatarola*	BBPL
Black Oystercatcher	*Haematopus bachmani*	BLOY
Black Turnstone	*Arenaria melanocephala*	BLTU
Surfbird	*Aphriza virgata*	SURF
Sanderling	*Calidris alba*	SAND
Dunlin	*Calidris alpina*	DUNL
California Gull	*Larus californicus*	CAGU
Herring Gull	*Larus argentatus*	HEGU
Glaucous-winged Gull	*L. glaucescens*	GWGU
Common Murre	*Uria aalge*	COMU
Pigeon Guillemot	*Cepphus columba*	PIGU
Marbled Murrelet	*Brachyramphus marmoratus*	MAMU
Mammals:		
Orca (Killer Whale)	*Orcinus orca*	ORCA
Wolf	*Canis lupus*	CALU
Raccoon	*Procyon lotor*	PRLO
Sea Otter	*Enhydra lutris*	ENLU
Northern Sea Lion	*Eumetopias jubatus*	EUJU
Hair Seal	*Phoca vitulina*	PHVT